

## THE AGE INCIDENCE OF POLIOMYELITIS IN CONNECTICUT 1921-1947\*

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During the past twenty years there has been occasional discussion in medical literature about the changing age incidence of poliomyelitis. In general this discussion has dealt with the evidence that poliomyelitis is no longer a disease which is confined more or less to infants. Comments on this have come from Australia,<sup>2</sup> Denmark,<sup>3</sup> Germany,<sup>4</sup> Sweden,<sup>1</sup> and from this country.<sup>4, 6, 7, 11, 16, 20, 22</sup>

In reviewing this subject briefly, one finds that at the turn of the century, "infantile paralysis," as it was then called, was considered to be "rather rare after the age of six."<sup>10</sup> Indeed more than 50 per cent of the cases were under two years of age. In one of the earliest epidemics in the United States, occurring in Vermont in 1894, 90 out of the 120 cases whose ages were given were under the age of six.<sup>3</sup> Today, however, in Scandinavia<sup>1, 6</sup> as well as in northern United States,<sup>7</sup> poliomyelitis is seemingly no longer a disease of infants; perhaps 70 to 80 per cent of the total cases occur in people over the age of five, and as high as 25 per cent in people over the age of 15 years.

This gradual shift in the age of the patients has apparently not taken place in some parts of the world, but in others it has progressed at varying rates during the past thirty years or so. The State of Massachusetts furnishes data in this regard, as originally exemplified by the studies of Forsbeck and Luther,<sup>6</sup> who observed no apparent change in age distribution of cases until 1918, twenty-five years after the initial epidemic in that state. After this time there occurred a marked decrease in the relative number of cases in the age group under five years, with a "compensatory" increase in the relative number of cases in the 5-14 age group. The percentage of cases in the older age groups was found to remain more or less constant.

Subsequently, in Connecticut, Knowlton<sup>11</sup> reported an increased percentage of cases over five years of age occurring in the 1931 series of cases as compared with the percentage distribution of cases in this age group for earlier years. And Wenner,<sup>20</sup> in a study of poliomyelitis in the city of New Haven and adjacent areas, found that about 25 per cent fewer children under five years were reported to have had the disease in 1943 as compared with 1916. A reciprocal increase was seen in the 5-9 and 10-15 age groups.

But it is not enough to indicate that the percentage of cases of poliomyelitis in the different age groups has shifted over the years—because, unless their shift is analyzed on the basis of *age-specific rates*, it may be found to be more apparent than real. In

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this connection Horton and Rubenstein<sup>10</sup> have again reviewed the Massachusetts data and have likewise found a decrease in the incidence of poliomyelitis there among children under five years of age, most marked between 1920 and 1930. They concluded, however, that the apparent variation in age distribution in Massachusetts has been due almost entirely to changes in the age distribution of the population and to an increase in the reporting of non-paralytic cases, and that there has been no essential change in the epidemiological behavior of the disease in that state.

Dauer<sup>4</sup> studied the same problem in a series of cases from five northern states (including Massachusetts and Connecticut) and five southern states, and found a consistent decrease in the proportion of cases in the age group under five years in each of the northern states since about 1916. In his analysis of *age-specific rates*, however, he found little evidence of a shift, i.e., a consistent rise or fall in any of the age groups except for the group under five in Massachusetts. He found changes in the age distribution of fatal cases similar to those in total number of cases except for a greater proportionate decrease in the deaths among the 0-4 age group. Consequently it would appear that the age specific mortality rates from Dauer's study do not indicate a consistent change since 1920 *except for those under five*, where a considerable reduction in mortality rate has occurred. This finding led Dauer to suggest that perhaps the disease is actually, as well as proportionally, becoming less frequent in this youngest age group.

Gilliam<sup>7</sup> also has recently examined the changes in *fatal* poliomyelitis occurring in the Death Registration States of 1910, during the period 1910-1940. His findings agree with those of Dauer, but he concludes that the decline in mortality in those under five years of age is a change that does not necessarily apply to the non-fatal disease.

Before one can account for these relative changes in the age incidence of poliomyelitis, a number of variables should be recognized. Thus the age incidence of poliomyelitis also varies with the density of population. Lavinder, Freeman, and Frost<sup>12</sup> and Nicoll,<sup>14</sup> in their reviews of the 1916 epidemic in New York city and state, confirmed previous observations on the differences in age distribution of cases between rural and urban communities, namely, that a greater proportion of cases occurred in older age groups in *rural* areas, with a higher incidence of the disease among young children in *urban* areas. Forsbeck and Luther<sup>6</sup> noted that over a seventeen-year period in Massachusetts the median age in the most sparsely populated density group was about eight, while the median age was about four in the most densely populated areas. But it is questionable whether the differences between rural and urban populations are as definite in this country today as they were a generation ago. Horton and Rubenstein<sup>10</sup> observed that as far as the age of poliomyelitis patients in Massachusetts is concerned, such differences are rapidly disappearing. This may not apply universally, however, for, in a single epidemic in western New York state and Pennsylvania in 1944, Paul<sup>15</sup> analyzed the age specific rates for urban and rural populations and found the high attack rates in the urban infants (0-4 group) still demonstrable in appreciable degree.

Granted that it is difficult to generalize about poliomyelitis from any single epidemic or series of cases from any single area, it is the aim of this study to determine whether or not an analysis of Connecticut data covering a period of some twenty-five years would lead to conclusions the same as

those of Horton and Rubenstein.<sup>10</sup> To this end an attempt has been made to measure the following items:

- (i) The epidemic history of poliomyelitis in Connecticut;
- (ii) The age distribution of cases each year since data became available;
- (iii) The age distribution of fatal cases each year since data became available;
- (iv) Population shifts between age groups and the effect of this upon the distribution of cases and fatalities;
- (v) Age trends in rural as opposed to urban populations.

### *Methods*

In order that data might be secured for this study, pertinent records of the Connecticut State Department of Health were made available through the kindness of the late Dr. E. E. Lamoureux, Director of the Bureau of Preventable Diseases, and his staff.

*Case records.* The material reviewed included morbidity and mortality reports of all cases of poliomyelitis which were reported to the Department of Health subsequent to 1900. Early records (1900-1920) are scanty, in fact poliomyelitis did not become a reportable disease in Connecticut until 1916. Not until 1920 did the reports become adequate for analysis. Consequently the study was limited to the period from 1921 to 1947. The age of the patient and time and place of onset of each individual case were obtained from these records. Unfortunately, adequate data concerning the differentiation of cases into paralytic and non-paralytic types were not available.

*Population estimates* of Connecticut towns used in the calculation of age-specific rural-urban analyses were obtained from reports published monthly in the Connecticut Health Bulletin by the Bureau of Vital Statistics of the State Department of Health and from Federal Census Figures. Populations of age groups used in the calculation of age-specific morbidity and mortality rates were from arithmetic estimates, based on Decennial Federal Census Figures, prepared by Eleanor J. Macdonald, Research Statistician of the Connecticut State Department of Health.

In attempting to correct the percentage distribution of cases for the population changes which have occurred within the various age groups during the period of time studied, mean annual, age-specific rates per 100,000 of the population were obtained for five-year periods. From the age-specific rates, the theoretical number of cases which could be expected in a normally distributed population was derived by adjusting these rates to a standard population, which, for this purpose, can be considered to be the population of age groups similar to those of the 1900 census in Connecticut. In comparing rates adjusted in this manner, any differences between one age group and another, or between the same age group in different years, may be considered to be independent of the effects of population changes.<sup>21</sup> Mortality rates were calculated in the same way as were case rates.

*Urban and rural cases.* In order to obtain a general picture of differences in rural and urban distribution, cases were divided into three groups—those from cities of

100,000 or more people, those from urban and town areas of 10,000 to 100,000 people, and the remainder from towns and rural areas of less than 10,000 people. Age-specific

TABLE 1  
POLIOMYELITIS IN CONNECTICUT 1916-1947

<i>Year</i>	<i>Cases</i>	<i>Deaths</i>	<i>Case rate</i>	<i>Mortality rate</i>	<i>Case fatality rate</i>
1916	951	277	73.6	21.4	29.1
1917	29	16	2.1	1.2	55.2
1918	51	16	3.6	1.1	31.4
1919	12	10	0.8	0.7	83.3
1920	41	23	2.9	1.7	56.1
1921	86	25	6.1	1.8	29.1
1922	47	16	3.2	1.1	34.0
1923	88	10	6.0	0.7	11.4
1924	120	23	8.0	1.5	19.2
1925	50	20	3.3	1.3	40.0
1926	32	6	2.1	0.4	18.8
1927	188	16	11.9	1.0	8.5
1928	70	12	4.8	0.7	17.1
1929	18	8	1.1	0.5	44.4
1930	70	17	4.3	1.1	24.3
1931	1,136	90	69.3	5.5	7.9
1932	29	7	1.8	0.4	24.1
1933	78	3	4.6	0.2	3.8
1934	14	2	0.8	0.1	14.3
1935	402	24	23.3	1.4	5.7
1936	16	4	0.9	0.2	18.8
1937	101	8	5.9	0.5	7.7
1938	18	0	1.1	...	...
1939	28	2	1.5	0.1	7.1
1940	16	3	0.9	0.2	12.5
1941	114	2	6.6	0.1	1.8
1942	46	2	2.7	0.1	4.3
1943	378	22	21.7	1.2	5.7
1944	219	10	12.5	0.5	4.6
1945	214	9	12.2	0.5	4.2
1946	212	16	6.8	0.9	13.2
1947	133	7	7.5	0.4	5.3

rates for cases from the earliest five-year period of the study and for cases from the last five-year period of the study were calculated from each of the three areas.

*Diagnostic nomenclature.* There has been a decided shift in clinical concepts during the past twenty-five years as to what constitutes a case of poliomyelitis. For instance,

more cases of non-paralytic poliomyelitis are so designated in the 1930's and 1940's than was the situation in the 1920's. But, on the other hand, it has become increasingly difficult to define a case of non-paralytic poliomyelitis. For instance, in the present day when extensive muscle testing is performed, transient weaknesses lasting only a day or two have been designated as "paralytic cases" and thus the problem of definition has again shifted with a tendency for an increase in the relative percentage of paralytic cases. No correction for this variability of diagnostic nomenclature has been applied in this study.

### *Results*

The first recorded epidemic of poliomyelitis in Connecticut was in 1905; two subsequent epidemics of major proportions have occurred since that time, in 1916 and 1931. The years between these epidemics have been characterized by intermediate peaks every two or three years. The incidence of the disease throughout its reportable history has been variable, with the total yearly number of cases ranging from twelve in 1919, to 1,136 in the epidemic of 1931. Table 1 lists the yearly number of cases and deaths with corresponding crude rates per 100,000 since 1916.

It is apparent here that the annual number of deaths has decreased somewhat and case fatality rates have shown a definite decline. This latter is probably due to gross under-reporting of clinical cases during the period immediately after 1916. Such an explanation is reasonable when one encounters a case fatality rate of some 40 per cent or more (!) during an epidemic year. It could either indicate that a strain of poliomyelitis virus of unprecedented killing power was about, or that only the more severe cases were being reported as examples of the disease. Of the two explanations the latter seems the more likely.

*Chronological trends in the percentage of cases in various age groups.* Table 2 shows the number of cases by age groups and their percentage distribution. The latter have been calculated from the number of cases with ages given, rather than from the entire total. There was a rapid decline in the percentage of cases in the 0-4 age group from 67 per cent of the total in 1921 to 15 per cent in 1947. This trend was most marked until about 1935, after which time the decline has been less obvious. A compensatory increase in the percentage of cases in the 5-9 and 10-14 age groups has occurred, with little consistent change in the older (greater than 15) age groups. The proportion of cases in the 5-9 group rose from 10 per cent of the total in 1921, to 50 per cent in 1934, after which time there has been a suggestion of a decline similar to that noticed in earlier years for the 0-4 age group.

The general age distribution does not seem to have been altered in years of particularly high incidence. Most of the deviations from the general

TABLE 2  
NUMBER AND PERCENTAGE OF CONNECTICUT CASES IN VARIOUS AGE GROUPS  
DURING THE PERIOD 1921-1947

Year	Number of cases by age group		Age groups										Total
	Age not given	Total with age given	0-4		5-9		10-14		15-19		20 plus		
			no.	%	no.	%	no.	%	no.	%	no.	%	
1921	20	66	44	66.7	7	10.6	4	6.0	4	6.0	7	10.6	100
1922	3	44	23	52.3	8	18.2	6	13.6	3	6.8	4	9.1	100
1923	3	85	51	60.0	23	27.0	9	10.6	1	1.2	1	1.2	100
1924	1	119	67	56.2	27	22.7	15	12.6	1	0.9	9	7.6	100
1925	0	50	17	34.0	20	40.0	6	12.0	2	4.0	5	10.0	100
1926	0	32	17	53.1	7	21.9	4	12.5	1	3.1	3	9.4	100
1927	18	170	70	41.2	57	33.5	22	12.9	5	3.0	16	9.4	100
1928	3	67	31	46.3	13	19.4	9	13.4	10	14.9	4	6.0	100
1929	0	18	5	27.8	5	27.8	4	22.2	0	0.0	4	22.2	100
1930	2	68	22	33.8	17	25.0	9	13.2	10	14.7	10	14.7	100
1931	7	1,129	414	36.6	412	36.5	178	15.8	69	6.1	56	5.0	100
1932	0	29	8	27.6	8	27.6	8	27.6	2	6.9	3	10.3	100
1933	0	78	13	16.7	36	46.2	14	17.9	7	9.0	8	10.2	100
1934	0	14	2	14.3	7	50.0	2	14.3	1	7.1	2	14.3	100
1935	16	386	118	30.5	137	35.5	70	18.2	35	9.1	26	6.8	100
1936	0	16	5	31.25	7	43.8	3	18.8	1	6.25	0	0.0	100
1937	2	99	28	28.3	36	36.4	22	22.2	5	5.0	8	8.1	100
1938	1	17	1	5.9	6	35.3	3	17.6	3	17.6	4	23.6	100
1939	0	28	6	21.4	10	35.7	6	21.4	2	7.2	4	14.3	100
1940	0	16	2	12.5	7	43.8	5	31.5	2	12.5	0	0.0	100
1941	2	112	23	20.5	32	28.6	29	26.0	17	15.2	11	9.7	100
1942	0	46	12	26.0	20	43.5	11	23.9	2	4.4	1	2.2	100
1943	6	372	100	26.9	112	28.6	100	26.9	32	8.7	28	7.3	100
1944	4	215	35	16.3	77	35.8	53	24.6	24	11.2	26	12.1	100
1945	7	207	29	14.0	59	28.5	53	25.6	27	13.0	39	18.9	100
1946	5	116	23	19.8	38	32.7	30	25.9	7	6.0	18	15.6	100
1947	5	128	20	15.7	41	32.0	29	22.7	19	14.8	19	14.8	100

trend are seen in years of especially low incidence, where there is a tendency for more cases to be distributed among the older age groups. Perhaps, as in the case of the bizarre fatality rates previously mentioned, much of this may be due to the under-reporting of clinical cases.

TABLE 3  
MEAN ANNUAL AGE-SPECIFIC POLIOMYELITIS CASE RATES IN CONNECTICUT  
WITH ADJUSTED PERCENTAGE DISTRIBUTION FOR FIVE-YEAR PERIODS  
1921-1945

<i>Age group</i>	<i>Number of cases</i>	<i>Population age group</i>	<i>Age-specific rate mean annual</i>	<i>Adjusted no. cases</i>	<i>% Dist.</i>
<i>1921-1925</i>		<i>1923</i>			
0-4	200	147,558	27.0	124.0	55.6
5-9	87	143,056	12.2	52.5	23.5
10-14	40	133,405	6.0	23.0	10.3
15-19	11	119,219	1.8	7.1	3.2
20+	26	905,269	0.6	16.5	7.4
<i>1926-1930</i>		<i>1928</i>			
0-4	145	137,093	21.2	96.0	45.0
5-9	99	149,820	13.3	57.0	26.7
10-14	48	152,431	6.3	24.4	11.4
15-19	26	139,864	3.7	14.5	6.7
20+	37	982,408	0.8	21.7	10.2
<i>1931-1935</i>		<i>1933</i>			
0-4	555	125,629	88.6	406.0	39.7
5-9	600	141,507	85.0	365.0	35.7
10-14	272	153,512	35.4	135.0	13.4
15-19	114	150,149	15.1	58.0	5.7
20+	105	1,066,145	2.0	57.0	5.5
<i>1936-1940</i>		<i>1938</i>			
0-4	42	113,514	7.4	34.0	29.4
5-9	66	123,138	10.8	46.0	39.8
10-14	39	142,621	5.4	21.0	18.2
15-19	13	153,523	1.7	6.5	5.6
20+	16	1,155,764	0.3	8.0	7.0
<i>1941-1945</i>		<i>1943</i>			
0-4	199	101,391	39.4	180.0	26.8
5-9	300	104,762	57.8	250.0	37.1
10-14	246	131,726	37.4	143.0	21.4
15-19	102	156,906	13.0	50.0	7.4
20+	105	1,245,434	1.7	49.0	7.3

*Chronological trends in age-specific rates.* Any interpretation of the figures presented in Table 2 must necessarily be withheld until the possible effects of changes in population distribution between the various age groups have been examined. Wenner<sup>22</sup> observed that in the city of New Haven, because of the lowered birth rate in recent years, there were about 30 per cent fewer children under the age of fifteen in 1943 than there were in 1920. If a similar reduction in the younger age groups has taken place in Connecticut as a whole, then the apparent decrease within these age groups may not be a real change at all. To correct for such population changes, age-specific rates and the adjusted number of cases were determined for five-year periods as described; they are presented in Table 3. Percentage distributions from this table are shown in Figure 1. When the percentage distribution of poliomyelitis cases is adjusted for population changes as in Table 3, the downward trend in the 0-4 age group becomes less marked than the decrease suggested by Table 2; yet a definite change remains. The 5-9 group shows the same initial rise and subsequent lesser decline, the 10-14 group shows a consistent rise, and the older age groups remain more or less constant.

*Age-specific mortality rates.* If the age-specific case rates and the theoretical adjusted number of cases derived therefrom can be said to rule out the effects of population changes, then it can be said that the trends in poliomyelitis age distribution are not entirely dependent upon alterations in the age of the population. In other words, to explain these trends additional factor or factors must be operative. It is believed that the reporting of *non-paralytic* cases has increased during the period of time covered by this study, and that it is probable, but not proved, that a larger proportion of these cases fall into the older than the younger groups. It would thus be

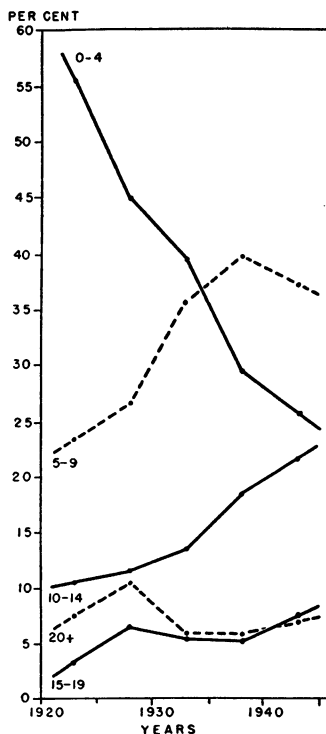


FIG. 1. Percentage distribution of age-specific case rates for poliomyelitis in Connecticut, 1921-1945. Each line designates the trend for a given age group: 0-4; 5-9; etc.

important to measure the age trends in a series of exclusively paralytic cases. In the absence of these data, however, it would seem that the age-

TABLE 4  
MEAN ANNUAL AGE-SPECIFIC POLIOMYELITIS MORTALITY RATES IN CONNECTICUT  
WITH ADJUSTED PERCENTAGE DISTRIBUTION FOR FIVE-YEAR PERIODS  
1921-1945

<i>Age group</i>	<i>Number deaths</i>	<i>Population</i>	<i>Mean annual mortality rate</i>	<i>Adjusted no. deaths</i>	<i>% Dist.</i>
<i>1921-1925</i>		<i>1923</i>			
0-4	41	146,558	5.6	25.4	40.0
5-9	11	143,056	1.5	6.6	11.0
10-19	20	252,624	1.5	12.0	19.0
20+	28	905,269	0.7	19.0	30.0
<i>1926-1930</i>		<i>1928</i>			
0-4	21	137,093	3.1	14.0	52.0
5-9	5	149,820	0.7	2.9	10.8
10-19	13	292,295	0.9	2.9	10.8
20+	12	982,408	0.2	7.0	26.4
<i>1931-1935</i>		<i>1933</i>			
0-4	29	125,629	4.6	22.6	30.0
5-9	39	141,507	5.5	23.7	35.7
10-19	33	303,661	2.2	16.7	18.1
20+	23	1,066,145	0.4	12.5	5.5
<i>1936-1940</i>		<i>1938</i>			
0-4	3	113,514	0.6	2.7	22.7
5-9	7	123,138	1.1	4.9	41.1
10-19	4	296,144	0.3	2.1	17.7
20+	3	1,155,764	0.1	2.2	18.5
<i>1941-1945</i>		<i>1943</i>			
0-4	2	101,391	0.4	1.8	6.0
5-9	9	104,762	1.7	7.5	28.2
10-19	23	288,632	1.6	12.2	46.0
20+	11	1,245,434	0.2	5.1	19.8

specific mortality rates would give supplementary information of value, since these cases should not be influenced particularly by the effects of the increased reporting of non-paralytic poliomyelitis.

Table 4 gives the age-specific mortality rates of age groups from 1921-1945. Percentage distribution of the theoretical number of deaths derived from these rates is presented in Figure 2. The percentage distribution of mortalities reveals the same general trends as do the total cases, except for the initial increase in percentage distribution of the 0-4 age group, and the corresponding early decrease in percentage distribution of the 10-19 and 20 plus groups. The age-specific mortality rates have little consistent variation in any of the age groups with the exception of the 0-4 group, which shows a general decline since 1921.

Table 5 illustrates the ratio of age-specific rates of the 0-4 group to the adjusted rate of all ages for all cases and fatal cases. Here again there is a relative decrease in incidence of poliomyelitis among those in the youngest age group. The tendency seems to be equally apparent in both the series of fatal cases and the total cases as indicated by the decreasing ratios over the successive periods of time.

Mention has also been made of one notable variable, namely, that the age incidence of poliomyelitis is related to population density. A number of analyses were made of this aspect of the situation in Connecticut. From them it was concluded that there is a tendency for younger cases to be relatively more numerous in the urban areas and the older cases relatively more numerous in the rural areas. But in general the data were not adequate for interpretation.

It is thus our impression that throughout the state of Connecticut the differences in the average age at which members of rural and urban populations contract poliomyelitis have never been very appreciable and are being largely erased.

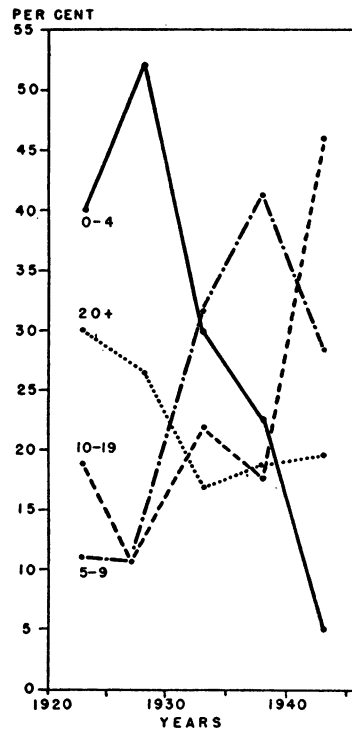


FIG. 2. Percentage distribution of age-specific mortality rates for poliomyelitis in Connecticut, 1921-1945. Legend as in Figure 1.

*Discussion*

We come now to the question as to whether the trend indicated by the data from Connecticut on the age incidence of poliomyelitis is significant, and if so, what can be made of it. The author believes that it is significant, that a trend away from the infantile disease is apparent, but that its

TABLE 5  
THE RATIO OF AGE-SPECIFIC RATES OF THE 0-4 GROUP TO THE ADJUSTED RATE  
OF ALL AGES FOR ALL CASES AND FATAL CASES  
ALL CASES

<i>Year</i>	<i>Mean annual age-specific case rate, 0-4</i>	<i>Mean annual adjusted case rate, all ages</i>	<i>Ratio*</i>
1916	386.0	65.0	5.9
1921-1925	27.0	4.9	5.5
1926-1930	21.2	4.7	4.5
1931-1935	88.6	22.8	3.9
1936-1940	7.4	2.5	3.0
1941-1945	39.4	14.8	2.7

## FATAL CASES

<i>Year</i>	<i>Mean annual age-specific death rate, 0-4</i>	<i>Mean annual adjusted death rate, all ages</i>	<i>Ratio*</i>
1916	96.0	17.7	5.7
1921-1925	5.6	1.4	4.0
1926-1930	3.1	0.6	5.2
1931-1935	4.6	1.6	2.9
1936-1940	0.6	0.3	2.0
1941-1945	0.4	0.6	0.7

\* This ratio is the quotient of age-specific case (and mortality) rate of the 0-4 age group, divided by the adjusted case (and mortality) rate for all ages.

explanation is complicated and probably obscure. It cannot be explained entirely on the basis of shifts in age distribution of the population of Connecticut which have taken place during the past twenty-five years, or of differing diagnostic criteria used for the recognition of poliomyelitis during that period. The reasons for not accepting the first explanation have been given. The reasons for not accepting the second need further discussion, for it is difficult to determine how much the diagnostic criteria

have changed during the past quarter century. There is little doubt that abortive poliomyelitis is today diagnosed more frequently than it was prior to 1930. In the epidemic of 1916 in New York, for instance, the non-paralytic cases amounted to about 13 per cent of the total.<sup>5</sup> In 1935, in that same city, the non-paralytic cases were reported as 33 per cent of the total.<sup>28</sup> But it is not clear what the situation is today in this age when careful muscle testing tends to increase the relative number of paralytic cases. Many cases that might have been called non-paralytic a decade ago are now classified as paralytic—the new criteria for paralysis being transient weakness of a few days' duration.\*

There has also been evidence that non-paralytic poliomyelitis is more common in the older age groups. Wickman<sup>23</sup> pointed out in 1913 that Müller made mention of the fact that non-paralytic cases were more numerous than the typical cases, especially among adults, and the same point was made in Denmark some twenty-five years later.<sup>8</sup> In 1933, Trask and his co-workers<sup>18</sup> showed that the paralyzed cases were more concentrated in the younger age groups than were the abortive cases and suggested that "there is a relationship between age and ability to abort the disease." That observation was made more than fifteen years ago and on the basis of 1932 diagnostic criteria, but the recent evidence is not yet available as to whether non-paralytic cases are today universally more common than are paralytic cases in the older age groups.

However, the answer to this problem could perhaps be achieved if only paralyzed cases were included in a series of this sort. From such a series in Massachusetts, Horton and Rubenstein<sup>10</sup> claim that the relationship between the morbidity rates of paralyzed cases in the whole population and the rates of paralyzed cases in the group under five years has remained relatively constant during the period 1910-1940, and that the relative decrease in similar ratios for total cases is therefore due to the increased reporting of abortive (a non-paralytic) poliomyelitis.

With the *fatal* cases this difficulty as to type of case of poliomyelitis should not arise, a point which has been made by Gilliam.<sup>7</sup> Therefore, an

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\* The diagnostic criteria used by the Yale Poliomyelitis Study Unit for the identification of *abortive poliomyelitis* are those of a disease which occurs coincidentally with paralytic poliomyelitis but in which there are no clinical evidences of meningo-encephalomyelitic involvement. The symptoms of this illness have been described by Paul, Salinger, and Trask<sup>17</sup> and by Horstmann and Paul.<sup>9</sup> The diagnostic criteria for *non-paralytic poliomyelitis* are those of an illness with clinical evidences of meningo-encephalomyelitic involvement but in which paralysis or muscle weakness is not apparent ten days after the onset of second phase symptoms. Different criteria are probably used elsewhere.

evaluation of changes in mortality rates should not be affected by an increased tendency to report non-paralytic cases. It should show the same general trends as would a study of paralyzed cases. Yet the relation between the mortality rates for poliomyelitis in the whole population and the group under five, as indicated in Table 5, is not constant, and decreases over the period of time studied in the same way that the similar ratios for morbidity rates decrease. This observation, in addition to the fact that there has been a decline in morbidity since 1921 in the age-specific mortality rates of the 0-4 age group (shown in Table 4), would seem to refute Horton and Rubenstein's premise<sup>10</sup> that the apparent variation in the age distribution of poliomyelitis has been due almost entirely to a change in the age distribution of the population and an increase in the reporting of non-paralytic cases. We may conclude, rather, that in Connecticut the data suggest a real tendency for the disease to affect the younger population less than formerly and this is due to reasons which are as yet unexplained. Theoretically these reasons could be associated with the average size of families—which has changed. They could be related to changes in the environmental (or living) conditions which have altered rapidly over the years regardless of whether or not such changes could be considered as improvements in sanitation. Or they could be related to many other features too numerous to mention here. Nevertheless it would seem important to continue to seek out these reasons. For whatever factor or factors are responsible for the change in the age incidence of poliomyelitis, they have some bearing on the etiology or epidemiology of this disease and as such may be of some moment in considerations of its control.

### *Summary*

The age distribution of cases of poliomyelitis in Connecticut have been studied chronologically over the period 1921-1947.

There has been a marked change in the proportionate age incidence of poliomyelitis in this state since 1921, with a relative decrease in the percentage of the cases in the 0-4 age group. In general, therefore, the disease no longer deserves the term "infantile paralysis" in this state.

Fatal cases have shown the same percentage age distribution as have the total cases as determined by the adjusted number of deaths derived from age-specific mortality rates.

It is concluded that these trends towards the "aging" of poliomyelitis patients cannot be directly explained merely on the basis of the "aging" of the population nor by the increased reporting of non-paralytic cases. Such trends are probably due to factors of which we are not yet fully informed.

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